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Sea Grant

Exploring the Potential and Protecting the Resource

Florida's Marine Sponges

by John Stevely¹ and Don Sweat²

Sponges are living, valuable residents of Florida's coastal ecosystems, providing habitat that is essential to a myriad of marine creatures, including spiny lobsters, one of the state's most important commercial fisheries.

Sponges have also made significant contributions to the cultural and economic legacy of several Florida coastal communities. The discovery in the mid-1800s that Florida bath sponges could compete on world markets created a flourishing sponge trade in the Keys. Sponge harvesting eventually expanded up the Gulf coast to Tarpon Springs, where Greek immigrants hired to work as sponge divers helped build a community now famous for its sponge history, Greek influence, restaurants, shops, bakeries and museums.

For a variety of reasons, the commercial sponge fishery in Florida today continues at just a fraction of its historic scale, but the study and management of sponge populations remains essential to the health of the state's coastal waters.

What Florida Sea Grant researchers are learning about the biology and commercial fishery of marine sponges — through regeneration studies and long-term views of population recovery following harmful algae blooms — is helping insure the sustainability of this resource for future generations. There is even promise that compounds derived from sponges can be developed into drugs and products with potential to enhance or prolong human life.



John Stevely (left) and Don Sweat, are Florida Sea Grant extension faculty who have conducted long-term research on Florida's sponge populations. Commercial sponge divers embraced their recommendation to cut, rather than tear sponges during harvest to promote regeneration. The measure is now state law. (UF/IFAS photo by Tom Wright)

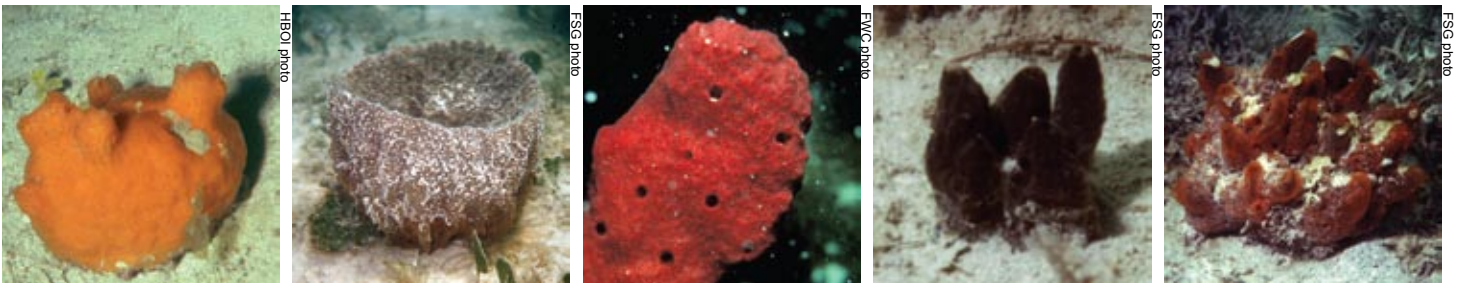
Sustaining the Sponge Resource

Sea sponges are a renewable resource. Florida Sea Grant research has shown that if sufficient sponge tissue is left attached to the substrate, the sponge can survive and regenerate.

In the northern Gulf, divers historically used a hook to tear sponges free from the bottom, but the industry has gradually moved to cutting sponges from the ocean floor based on Sea Grant studies showing survival rates can be as high as 71% for cut sponges versus 41% for those hooked. In the Keys, where diving for sponges is prohibited, hooked sponges grow back about one-third of the time.

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Marine sponges come in varying shapes and sizes — more than 9,000 species have been described worldwide. Gulf and Caribbean species include, from left, *Forcepsia*, vase, finger, brown tube, and fire sponges.

Based on the industry’s embrace of the cutting practice and Sea Grant recommendations, the Florida Fish and Wildlife Conservation Commission (FWC) passed a measure that now requires sponge divers to harvest sponges by cutting. This insures that the sponge can grow back, and produce another harvestable sponge.

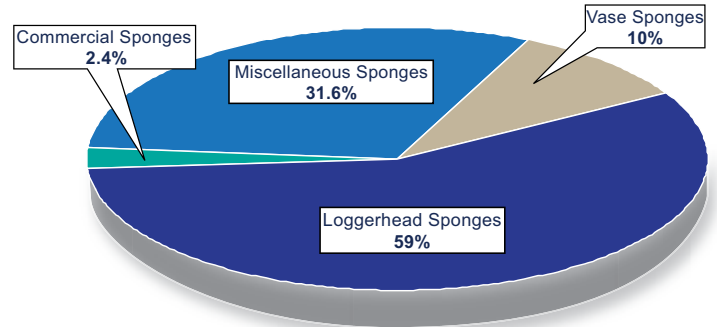
The remarkable regenerative ability of sponges has led to attempts to “farm” sponges in Florida. A sponge could be cut into pieces, attached to a concrete disk, and the sponge would grow to a commercially valuable product. However, slow growth rates, poaching, and most importantly, periodic episodes of sponge disease worked against the practice of densely “planted” sponges.

There are several fisheries management measures intended to protect Florida’s sponge fishery.

- Minimum Size: All sponges must have a minimum dimension of 5 inches.
- Sanctuaries: Sponge harvesting is prohibited in Everglades National Park and Biscayne National Park.
- Diving for sponges is prohibited in the clear shallow waters of the Florida Keys.
- In those areas of the northern Gulf where sponge diving is permitted, divers are required to harvest sponges by cutting rather than tearing the sponge free from the bottom.

Worldwide over 9,000 species of sponges have been described, but just a few species are of economic importance. Only those species that have a skeleton made of spongin fiber, a protein-like substance somewhat similar to hair and arranged in a particular pattern, are durable, soft, and able to absorb water. In general, these species are not found in coral reef areas and research has shown that they represent a very small part (2.4 percent) of the sponge community in Florida habitats where they are harvested.

Five species in Florida are harvested commercially. Three of these — the sheepswool sponge, yellow sponge, and the grass sponge — are most marketable. Two other species, the glove sponge and finger sponge, easily fall apart when used, and only very small numbers are harvested for ornamental purposes. Sheepswool is the most important species because it is the softest and most durable.



Commercial varieties constitute a small fraction of Florida’s marine sponge population. Of the five species harvested commercially, sheepswool is the most important.

Future Miracles from the Sea

Some non-commercial sponges may contain the secrets for important pharmaceutical breakthroughs. Many of the biologically active compounds from sea-dwelling creatures that are used in medical research come from sponges. Because sponges are sessile creatures (cannot move), they have evolved built-in chemical defenses to deter predation and enable them to compete with other organisms for living space.

Sea Grant researchers at Harbor Branch Oceanographic Institute (HBOI) are currently working on identifying and manufacturing new cancer-fighting drugs from sponges. They have isolated compounds called lasonolides from the species *Forcepsia*, a small, nondescript reddish sponge, that shows an ability to kill lung, breast, and other cancer cells. The deep-sea sponge *Discodermia* produces a chemical compound called discodermolide that has proven extremely potent at treating pancreatic cancer, and is in human clinical trials with a pharmaceutical company.

Researchers are working toward getting other sponge-derived compounds into clinical trials and then on to market. They are also working on a number of novel techniques to raise healthy cultures of sponge cells that produce these vital bioproducts, in order to balance the need for collecting sufficient samples for manufacturing pharmaceuticals without exhausting the supply of sponges from the sea.



The worldwide demand for Florida sponges in the 19th century spawned a thriving fishery in the Florida Keys. Above, sponges are auctioned from the wharf at Key West. (NOAA photo)



In the Keys, where diving for sponges is prohibited, fishermen harvest sponges by using a hook on a long pole to tear a sponge free from the bottom. Off the Gulf Coast near Tarpon Springs, sponges are found in deeper water and diving gear is allowed. (FSG photo)



During a messy curing process, the tough outer black skin covering the living sheepswool sponge (left) is removed, as is the debris remaining in the sponge's canals. Market price is determined in part by how well the sponges have been cleaned. (FSG photos)

Harvesting Sponges for Market

The living sponge is much different in appearance than the cured, commercial sponge. In its watery habitat, a living sponge is covered with a black 'skin.' To the untrained eye, it may be difficult to discern, but commercial spongers are adept at distinguishing commercial varieties from other species.

In the Florida Keys sponges are harvested by hooking. When the water is clear and the wind is calm, fishermen working from small boats (sometimes associated with a larger "mother" ship) scan the bottom until they have spotted a sponge. They use a long pole with a hook to tear the sponge free from the bottom. The hook is 5 inches across and is used to measure the sponge to insure it is legal size.

In the northern Gulf, sponges are found in deeper water, so diving gear is allowed to harvest sponges. Divers use a knife to cut the sponge free from the sea floor.

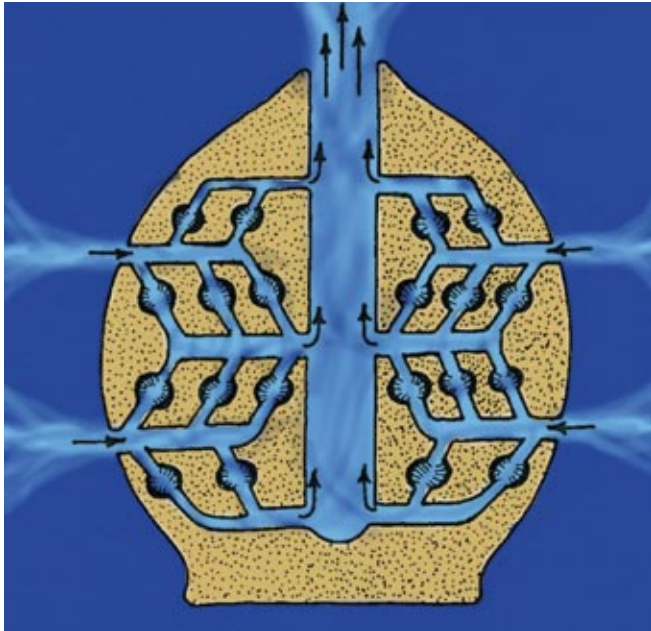
Cleaning sponges requires several steps. First, they are removed from the water to allow the living tissue to die. Sponges are then kept under wet burlap or returned to the water to allow a rotting process to continue for several days. This helps in the removal of the outer "skin" and other non-skeletal tissue. The final step is to squeeze, or paddle, the sponges so the remaining skin and tissue is eliminated and only the sponge skeleton remains.

History of Florida's Sponge Fishery

Since the time of the ancient Greeks, people have recognized the usefulness of natural sea sponges. Because of their ability to absorb water and their soft compressible nature, sponges have been used in a variety of ways ranging from personal bathing to industrial applications. Synthetic sponges, by comparison, are not nearly as absorbent or durable, and are harder to clean. Today, marine sponges continue to be in demand by consumers willing to pay a premium price for a superior natural product.

Historically, the world's sponge supply came from the Mediterranean Sea. In the mid-19th century, however, suitable sponges were found in Florida and the Caribbean. Important sponge fisheries quickly developed, with Florida, Cuba, and the Bahamas becoming the primary producers. Until the 1890s all of Florida's sponges were harvested from the Florida Keys, but the discovery of commercial sponges in the northern Gulf of Mexico, along with the introduction of Mediterranean deep-diving techniques, led to the rapid growth of the industry in Tarpon Springs.

By the early 1900s, the sponge trade had become the most valuable fishery in Florida. Mediterranean fishermen introduced sponge diving techniques to the Tarpon Springs fleet, and a rich, Greek culture began to flourish. But then, a number of factors, including a mysterious disease in the late 1930s, red tides, overfishing, and introduction of synthetic sponges during the 1950s, shrunk the fishery to a small fraction of its former importance. Prior to World War II, Florida annually produced approximately 600,000 pounds of sponges. Today, production totals just 60,000–70,000 pounds.



Sponges feed by pumping water through an elaborate system of canals and chambers to filter small particles of food that are consumed. The structure also provides habitat for other organisms such as shrimp and marine worms. (Adapted from John F. Storr, 1957)

Sponge Biology

Sponges obtain their food by filtering microscopic food particles from the water. In some habitats they are the dominant filter-feeding organism. They are somewhat distinctive from other filter-feeding organisms (clams, barnacles, sea squirts) in that they can filter even microscopic food particles down to the size of bacteria. Scientists have discovered that many sponge species contain symbiotic algae that can also help provide nutrition.

Sponges also pump remarkable quantities of water through their complex system of canals and chambers. Water is pumped through small openings on the side (ostia), filtered through a maze of canals and chambers, and then expelled through larger openings on the top of the sponge. Water is driven through the sponge by special cells equipped with a twirling, whip-like filament (flagellum).

The sponge's canals and chambers provide habitat for a myriad of small shrimp-like and worm-like organisms. In a way, sponges can be thought of as apartment buildings for these organisms. The inhabitants do not appear to cause any harm.

Interesting Sponge Facts

- Bath sponges may be the first non-edible product harvested from the sea.
- One of the first drugs for successfully treating cancer, cytosine arabinoside, was isolated from a Caribbean sponge, *Cryptotheca cripta*.
- In recent decades, Sea Grant marine extension faculty have provided assistance to farm sponges in Micronesia.
- It is thought that some sponges live for a very long time, perhaps over 100 years.
- Sponges are remarkable pumping 'machines.' In general, considering the different types of sponges there are, sponges can pump 10,000 times their own size (volume) in water in one day. A sponge the size of a gallon milk container could pump enough water to fill a residential small size swimming pool within one day.
- Recent Sea Grant research has shown that shallow-water sponge populations in the Keys are much more dynamic than previously thought to be.
- On average there are approximately 13 sponges to the pound.
- Because of their sessile nature, biologists once considered sponges to be plants. However, sponges are indeed a part of the animal kingdom, but they are very much different than the types of animals that are familiar to most people. Actually, in many ways, sponges can be considered to be a colony of single-celled organisms that work together in a coordinated fashion to survive.

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